TEAMALBERTA

Evaluating energy efficiency of on-farm grain conditioning systems

Year-one observations from a groundbreaking study on the efficiency of in-bin supplemental heating and heated air dryer systems for grain conditioning.

As part of a three-year study, select in-bin supplemental drying systems and heated air drying systems in Alberta were monitored during the 2019 harvest season to assess the typical energy consumption that farmers experienced. The long-term objective of the study is to fill the data gaps related to the efficiency of in-bin supplemental heating systems and heated air dryers that Alberta farmers use. This information will assist on-farm decision making and guide government programs and policies.

Observations from the 2019 grain conditioning study

Variable efficiencies among in-bin supplemental heating systems.

There were a wide range of efficiencies discovered for in-bin supplemental heating systems. The most efficient systems had an efficiency three to four times higher than the others.

Indirect-fired in-bin supplemental heating systems had high efficiencies in year one.

The indirect systems had higher efficiencies than expected. Producers using indirect heated systems consumed an average of 42 per cent less energy per tonne of moisture removed.

In-bin supplemental heating systems that ran higher supply temperatures than suggested displayed higher efficiencies.

The overall amount of energy consumed with higher temperatures during the drying cycles was lower, resulting in higher efficiencies.

Some heated air drying systems had higher efficiencies than specified.

Setup and operation can affect the overall efficiency experienced when drying.

Next steps for the grain conditioning study

Years two and three will focus on increasing the data in order to better understand the variables and impact on efficiencies. Next steps include:

Additional measurements of in-bin systems to better understand variables impacting efficiencies.

More testing is needed to quantify the differences in setup and control methods to identify the factors that have the greatest impact on efficiency (control method, temperatures, heater setup, air flow rates, etc.).

Testing differences between indirect and direct-fired systems to understand the impact on efficiencies for in-bin supplemental heating systems.

The amount of moisture added to the grain through direct-fired systems is relatively small, however, the difference in efficiency was noticeable. Additional testing is needed to quantify the changes.

Understanding the impact on grain quality with higher in-bin supply air temperatures.

Although producers experienced greater efficiencies with higher supply temperatures, the overall impact on grain quality is not fully understood at this time. Additional work is needed to assess the overall potential for higher supply temperatures.

Regardless of the type of in-bin supplemental heating equipment and operating method, there are several practices producers should consider for their setup:

- **Monitoring.** Understanding the condition of the grain moisture content and temperature will help guide management decisions for fan and heater control strategies.
- **Ventilation.** Ensure adequate headspace ventilation is available to allow the warm, moist air to be escape. A “rule of thumb” for the minimum required area is one square foot of vent space for every 1000 cfm of air flow.
- **Cooling.** Grain should be cooled to less than 15°C after drying for safe long-term storage. Cooling will also remove some moisture, so drying may be complete when moisture is within 0.5 per cent of target.
- **Turning.** Consider turning the bottom grain once the average bin moisture is dry to even out the moisture content in the bin.

For more information on the grain conditioning project please contact Shannon Sereda at ssereda@albertawheatbarley.com

For the full report on the year one results by 3D Energy Limited, click below.

View Full Report

About Team Alberta's grain conditioning project

This study is monitoring a total of 36 in-bin systems and five continuous grain dryers.

Team Alberta is working with 3D Energy Limited and the Prairie Agricultural Machinery Institute to assess the energy consumption of grain drying in Alberta. Funded in part by the Canadian Agricultural Partnership, this three-year study will result in the development of a guide for farmers who are seeking efficiency improvements on their drying systems. In addition, the information gathered will be used to direct policy and programming such as quantifying the impact of the carbon tax and recommendations to reduce these costs for farmers.

A total of 36 in-bin systems and five continuous grain dryers are being monitored for this study. However, only 32 in-bin systems and three continuous dryers were utilized in 2019. Of the 32 in-bin systems, 22 are direct-fired natural gas systems, seven are indirect-fired diesel or natural gas-fired (four are diesel and three are natural gas), and three bins are heated using solar air collectors. Energy consumption per tonne of moisture removed (specific energy) was the chosen energy performance metric. This metric allows for an easy comparison between different types of systems regardless of initial grain moisture, final grain moisture and the volume of grain dried.

Team Alberta is a working collaboration between Alberta Barley, Alberta Canola, Alberta Pulse Growers and the Alberta Wheat Commission.

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Alberta Wheat COMMISSION

Team Alberta represents a working collaboration between four of Alberta's crop commissions: Alberta Barley, Alberta Canola, Alberta Pulse Growers and the Alberta Wheat Commission.

We work together with the aim to provide input to policy makers, ensure long-term access to markets, promote the sustainability of the crop sector, and advocate on behalf of farmers while enabling grass-roots advocacy by our farmer members.